NHB–3 TUNING INSTRUCTIONS

AMENDMENT RECORD SHEET

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TUNING INSTRUCTIONS

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Tuning Instructions

General

Almost all tuning operations of the NHB–3 are carried out using the Service software. The Service software turns the phone into the service mode, in which the phone can be outwardly controlled via the M2BUS interface.

Tuning is based on the Service software communicating with the D/A and A/D converters of the phone. In some instances the phone processor will also calculate the required correction parameter.

The tuning values of the phone reside on the EEPROM. The Service software enables writing the default parameters on the EEPROM (Factory Reset), in which case all tuning steps should be carried out.

N.B. **During tuning, proceed as follows:**

- Take care not to damage sensitive measuring instruments with excessive RF power, use attenuator if needed.
- Carry out all tuning steps in the shortest possible time to avoid excessive heating of RF units.
- Perform all tuning steps in the order presented.
- Never try to mask a fault by tuning it out!

Required Equipment

- PC/AT computer with Service software; see specific section for intructions on installation and use of Service software.
- M2BUS adapter DAU–2 and other service accessories; see equipment set-up pictures.
- Multimeter or DVM.
- DCS1900 radio telephone test station or separate measuring equipment as follows:
    - RF generator
    - pulse power meter
    - spectrum analyzer
    - attenuator and branching unit

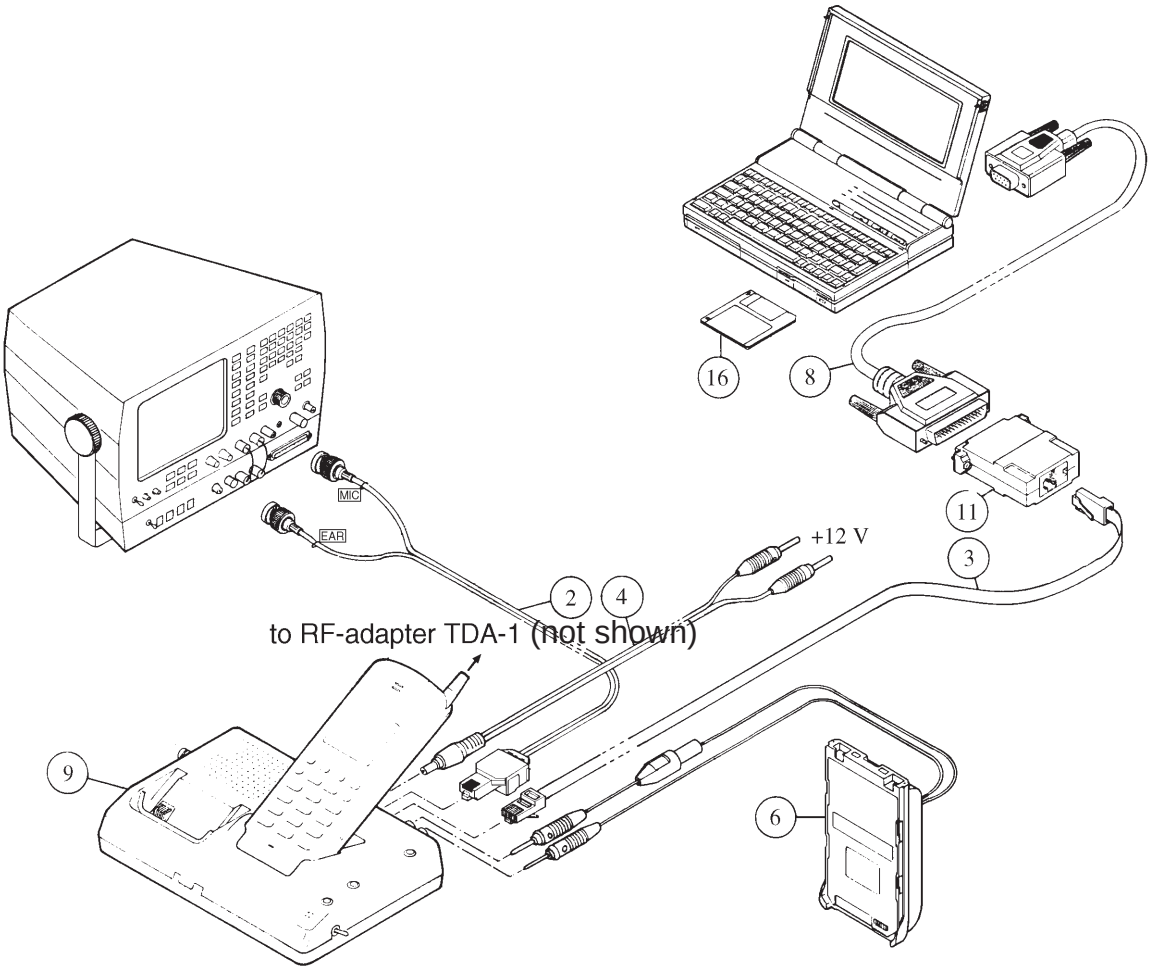
Equipment Setup

To set up the equipment, connect the M2BUS adapter to the serial port (RS–232) of the computer. In case you are using a 9–pin serial port (normal with an AT set) use the mating adapter supplied with the M2BUS adapter. Turn off the computer before connecting to avoid possible damage to the serial port.

Attach one end of the XCM–1 modular cable to the DAU–2 PC/M2BUS adapter and the other end to the JBS–7 service box. Use suitable adapter, RF cable with the proper RF antenna replacement adapter when the covers of the phone are in place**,** JBS–16 test frame when the phone covers are off, and attach it to the phone. Then connect the phone or the cables of test frame JBS–16 to the service box JBS–7.

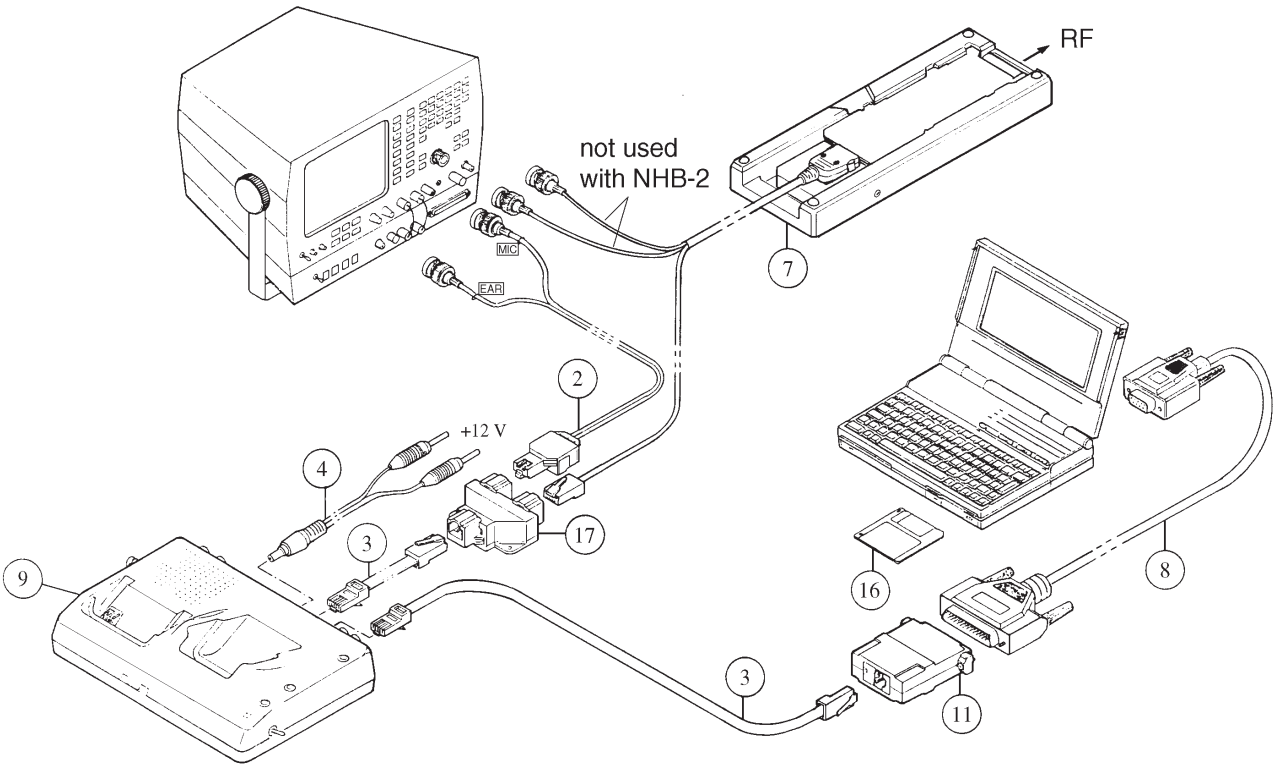
While replacing the antenna with the RF adapter, carefully remove the antenna of the phone and the plastic tube and replace it with the TDA–1 antenna adapter. **Do not overtighten the RF adapter** or the antenna support threads may get stripped and replacement of antenna bracket will be necessary.

Equipment Setup For Tuning A Phone Without Removing Covers



Item:	Service accessory:	Product code:
	RF Antenna adapter + RF cable, TDA–1 (not shown)	0750086
2	Audio cable, ADS–1	0730011
3	Modular cable, XCM–1	4626131
4	Power connector, PCS–1	0730012
6	Dummy battery, BTS–4	0770009
8	RS–232 adapter (9 pin to 25 pin)	4626170
9	Service box, JBS–7	0770015
11	PC/M2BUS adapter, DAU–2	0750006
16	Service software diskette 3.5”	0774024
16	Service software diskette 5.25”	0774025
–	Software protection key PKD–1 ”dongle” (not shown in the picture, needed to connect the parallel port of the PC)	0750018

Equipment Setup For Tuning A Phone With Removing Covers



Item:	Service accessory:	Product code:
2	Audio cable, ADS–1	0730011
3	Modular cable, XCM–1	4626131
4	Power connector, PCS–1	0730012
7	Test frame with RF antenna adapter, JBS–16	0775039
8	RS–232 adapter (9 pin to 25 pin)	4626170
9	Service box, JBS–7	0770015
11	PC/M2BUS adapter, DAU–2	0750006
16	Service software diskette 3.5”	0774024
16	Service software diskette 5.25”	0774025
17	Modular T–connector	4626134
–	Software protection key PKD–1 ”dongle” (not shown in the picture, needed to connect the parallel port of the PC)	0750018

Starting The Program

The program is delivered on a diskette and is copy protected with a dongle. The program can also be installed on the hard disk, which is recommendable to obtain a maximum data access rate. In case you want to store the program to the hard disk, proceed according to instructions given in Service Software installation manual.

The program is started with the command:

NHB2SERV <Enter>

The program can be set up work with different serial ports or display types.

Starting options for Service software

The program is started by entering the following command:

NHB2SERV –?, –h, ?, help, –c[com port], –f[setup file], –l[lpt port], –t[text mode]. –v[video control]

where:

–?, h, ?, help	=	Help on following options.
[–com port]	=	The communication port used for M2BUS (COM1 , COM2, COM3 or COM4). For example: –c1 or –c2
[–setup file]	=	Name of the used setup file. (Default=NHB_2.con)
[–lpt port]	=	LPT port for PKD–1 (1, 2, 3 or 4) Default=1
[–text mode]	=	screen text mode (BW80,CO80, MONO, BW4350, CO4350, LAST). For example: –tco80 (=Default), –tmono, –tbw80 or –tlast
[–video control]	=	Video control (HW (=Default) or BIOS). For example –vHW

Tuning Steps

1. AFC Diagram Storage

This tuning is used to calibrate the automatic frequency control range.

AFC tuning:

Reference value for the received signal strength meter are program tuned.

RSSI reference signal level programming:

– Select Main menu option 7, ”Phone mode” to change phone mode to local if it is not done already.
– Check that ” Cont mode channel” is 661.
– Select: option 3 ”Testing and adjustment” and option 2 ”Adjustment”.
– Set RF generator frequency 1960.06771 MHz at level –45 dBm + RF cable and RF antenna adapter attenuation.
– Select adjustments menu option ”AFC Diagram” and press <Enter>
– The measurement result should be;
    - Low –26...–14 kHz
    - Middle ±3.0 kHz (depends on generator frequency accuracy)
    - High 14...26 kHz
– Press <Esc> key and store values to EEPROM with <Y> key.

2. RSSI Reference Signal Level Storage

– Start the service software and go to ”Main” menu.

– Initialize phone by pressing <2> in the PC keyboard or by choosing ”initialize” with cursor keys and by pressing <ENTER> to confirm the selection.

– Select ”Phone mode” and select local mode with <Enter> key or by pressing simply the <7> key.

– Select ”Testing and Adjustments” menu and press <Enter>.

– Select ”Adjustments” menu and press <Enter>.

– Select option 1, ”Continuous channel mode”.
–change channel mode to 661
–press <ESC>

– Connect RF generator to antenna connector at 1960.06771 MHz (Channel 661).

– Adjust signal generator level to –75 dBm + RF cable and RF antenna adapter attenuation (for example with 2.5 dB attenuation the level is –72.5 dBm).

– Select ”RSSI Calibration” and press <Enter>.

– Press <Enter> key from PC keyboard to measure the signal strength.

– Adjust generator signal amplitude level to –45 dBm + RF cable and RF antenna adapter attenuation.

– Press <Enter> to measure the signal strength.

– DAC values should vary from 12 to 25 units between each step.

– Press <Esc> key.

– Store the value to the EEPROM with <Y> key.

3. I/Q Modulator Amplitude Balance and Phase Shift Tuning

The purpose of this tunig operation is to adjust the I/Q modulator d.c. offsets and the I/Q modulator amplitude balance and phase shift.

I/Q modulator d.c. offsets, amplitude balance and phase shift tuning:

– Connect spectrum analyzer (with attenuator if needed) to phone antenna connector.

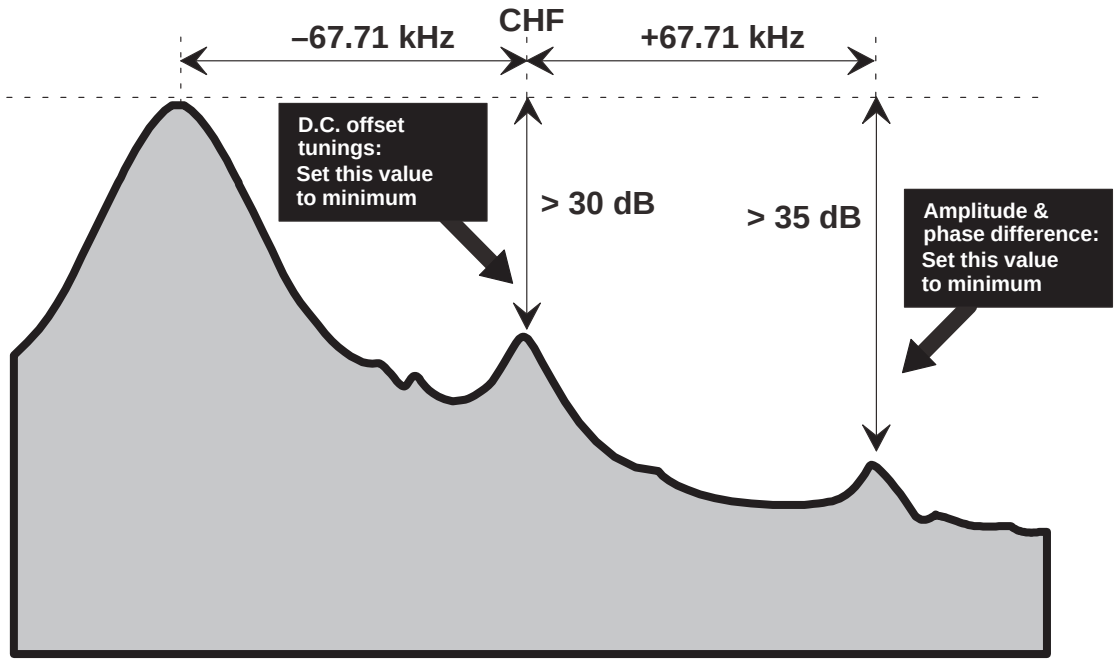
– Select adjustment menu option ”TX I/Q Tuning” and press <Enter>.

– Check that TX power level is level 5, Cont. mode channel is 661 and TX data type is 1.

– Adjust spectrum analyzer centre frequency to 1880 MHz, Ref level to 30 dBm and Span 200 kHz (500 kHz can be used to see both sides of the spectre)

– Set also Res BW to 10 kHz, Video BW 1 kHz and Sweep time 1.0 s.

– Set triggering to Free Run


–67.71 kHz
CHF
+67.71 kHz
D.C. offset tunings: Set this value to minimum
> 30 dB
> 35 dB
Amplitude & phase difference: Set this value to minimum

– Select option ”TX I DC offset”.

– Adjust the level of centre frequency (CHF signal) to minimum by varying D/A converter value with <+> and <–> keys (or occasionally cursor left and right keys).

– The amplitude difference between CHF–67.7 kHz and CHF should be >30 dB (See picture).

– When value is OK move to the next option with cursor keys.

– Select option ”TX Q DC offset”.

– Adjust the level of signal CHF to minimum by varying D/A converter value with cursor left and right keys or <+> and <–> keys.
– When value is OK move to the next option with cursor keys.
– Select option ”TX I and Q DC offset” .
– Adjust the level of signal CHF to minimum by varying D/A converter value with cursor keys or <+> and <–> keys.
– When value is OK move to the next option with cursor keys.
– Select option ”Tune Amplitude Difference”.
– Adjust the level of signal CHF+67.7 kHz to minimum by varying D/A converter value with cursor keys or <+> and <–> keys.
– The amplitude difference between CHF+67.7 kHz and CHF–67 kHz should be >35 dB (See picture).
– When value is OK move to the next option with cursor keys.
– Select option ”Tune Phase Difference”.
– Adjust the level of signal CHF+67.7 kHz to minimum by varying D/A converter value with cursor left and right keys or <+> and <–> keys.
– When spectre is minimized press <Esc> key and store new values to EEPROM with <Y> key.
– Press <ESC> key to return to upper menu (Testing and Adjustment).
– Select option ”RF Controls”.
– Change ”TX Data Type” value from one to zero or from zero to one depending on wich value the option had.
– Press <ESC> key to return to upper menu (Testing and Adjustment).
– Select option ”Adjustment”.
– Select option ”TX I/Q Tuning”.
– Press <Y> key to load values from EEPROM.
– Minimize the spectre like explained earlier. Check the other side of the spectre once more.
– When both sides of the spectre are minimized, press <Esc> key and store new values to EEPROM with <Y> key.

4. Tuning of Transmitter Power Levels

This adjustment loads the power levels of the phone transmitter into the EEPROM. When doing this, a pulse power meter or spectrum analyzer must be used.

Power levels programming:

– Set power supply voltage to +6.0 V.
– Connect pulse power meter or spectrum analyzer to antenna connector.
– Check that continuous mode channel 661.
– Select adjustments menu option ”TX Power Tuning” and press <Enter>.
– Press <Y> to load values from EEPROM.
– Adjust spectrum analyzer centre frequency to 1880 MHz, Ref level to 30 dBm and Span 0 Hz.
– Adjust spectrum analyzer Attenuation to 40 dB, Res BW to 3 MHz, Video BW to 3 MHz and Sweep Time 10 ms. Set triggering type of the spectrum analyzer to VIDEO. Possible marker is set to PEAK.
– Adjust the power level (levels 0, 5, 10, 11 and 15) with cursor left and right keys or <+> and <–> keys and change levels with <Up> and <Down> keys.

Power level	**Tuning P_{OUT}/dBm (VB=6.0 V, CH698)**
0	30 *tune first !*
5	20
10	10
11	8
15	+0 (positive value preferred)

NOTE: Remember the RF cable attenuation (for example with 2.5 dB cable and RF antenna adapter attenuation power level 0 is 27.5 dBm instead of 30 dBm).

– When the correct values for TX Power levels of 0, 5, 10 11 and 15 are tuned with accuracy of +/– 1 dBm, press <F3> to calculate all other levels.
– Once all TX levels are OK, press <Esc> and store readings in phone to EEPROM with pressing <Y>.

5. Charge Voltage Adjustment

A reference value for charge voltage is set by using an accurate 6.0 V supply.

Calibration of the charge voltage:

– In case the phone covers are not removed replace the standard battery of the phone with the dummy battery BTS–4.
– **Apply +6 V to charger connector of the phone.**
– Select adjustments menu option ”Charge Voltage Adjustment”.
– Program reads +6 V, A/D reading fed to charger input.
– Let the software measure a couple of seconds and press <ESC>.
– Store charge voltage value to phone EEPROM by pressing <Y>.

6. Battery Voltage Adjustment

A reference value for battery are calibrated by using an accurate 6 V supply.

Calibration of the A/D converter channels:

– In case the phone covers are not removed replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6 V to dummy battery.
– Select adjustments menu option ”Battery Voltage Adjustment”.
– Program reads 6 V, A/D reading fed to phone VBAT line.
– Let the software measure a couple of seconds and press <ESC>.
– Store correct value to phone EEPROM by pressing <Y>.

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